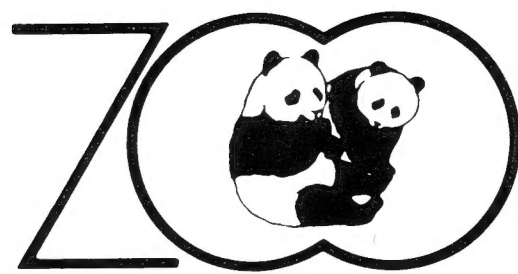


ZOOHOVER

September-October 1987

Species
Survival
(p. 4)

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Cover: The gorilla is one of 36 species targeted for zoo propagation and research under a Species Survival Plan (page 4). Photo by Benjamin Boblett. **Back cover:** Some species of arrow poison frogs, like this resident of the Reptile House, lay and fertilize a small number of eggs which are periodically "watered" by the male until they hatch. Photo by Jessie Cohen, NZP Graphics.

CONSERVATION PRIORITIES

Dear FONZ Member,



Robinson with tarantula

I agree completely with Michael Soulé's evaluation of the arguments for the conservation of what have been called the "charismatic megavertebrates" ["Scarce Resources and Endangered Species," p. 13]. In the last analysis, the arguments that he examines do not stand close scrutiny. Clearly, in a biological sense, many of the species upon which public attention has focused are not the critical species in their ecosystems, and their preservation will not ensure the survival of a particular system by any "blanket" effect.

How can we evaluate what passengers to save if the Ark has only a few vacancies? We could certainly be wiser to the ecological role of the chosen few than we have been, but affection for certain kinds of animals, and other kinds of emotionally based preferences, cannot be ignored. Giant pandas are perfect symbols for conservation because they evoke the "cute" response. Whales and dolphins moved up in the affectional scale because conservation palates became sophisticated as a result of the work of oceanariums and media exposure.

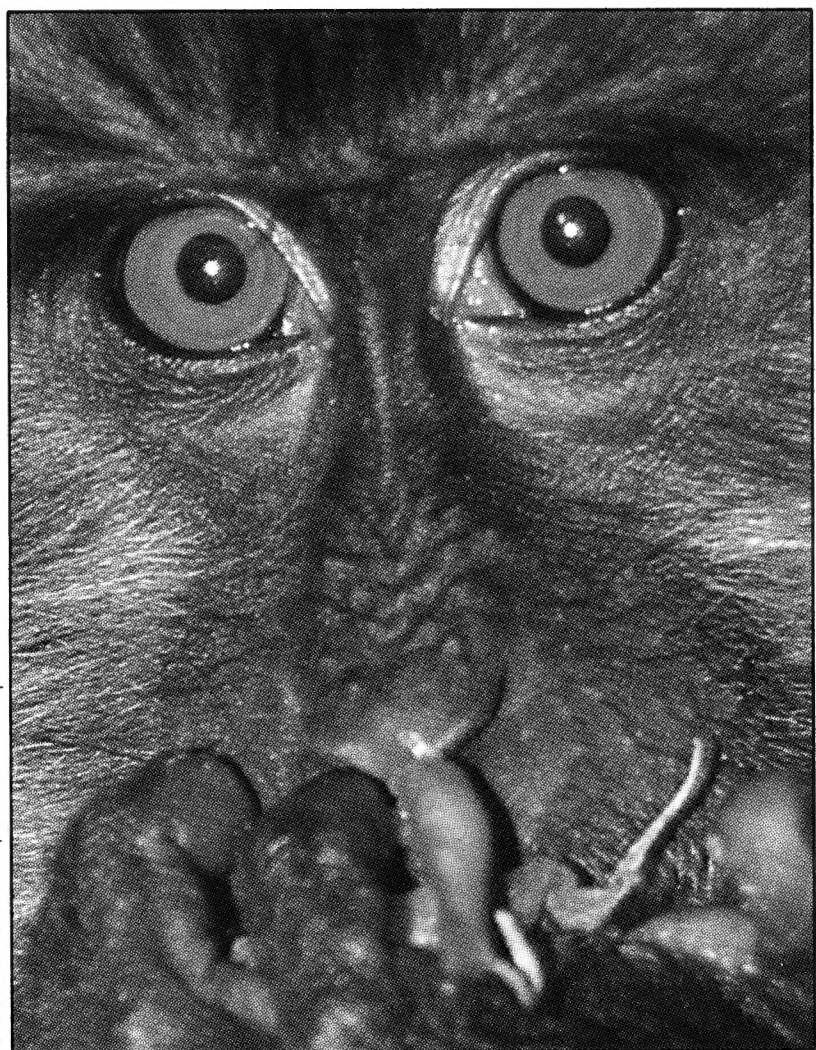
My view is that saving species would be a waste of time if we only saved the photogenic, the attractively odd, or those with which we could feel some sense of identification. If we are in fact losing thousands of species each year because of habitat destruction, we should be saving habitats not species.

And there's the rub. To save habitats, particularly in faraway places, people need something to identify with. Something has to be found that symbolizes the threatened ecosystem. The bamboo forests of China cannot mean much to most people, but an apparently cuddly black and white teddy bear can. Pandas have come to symbolize something broader, for they are an educational and conservation focus. Similarly golden lion tamarins. Few people beyond a handful of connoisseurs will shed a tear for the destruction of Brazilian coastal forest. But symbolize that forest with a strikingly colored small monkey and one has a campaign, and a campaign logo.

In the end I feel strongly that zoos are potentially the most powerful tools for conservation that can exist in a democratic society. I feel this not because by our ingenuity we can save "masterpiece" species, although we can. I rate the zoo so highly because I think that if people are exposed to beautiful, wonderful, and exciting species, they can be moved to save the art gallery and not merely the masterpieces.

Sincerely,

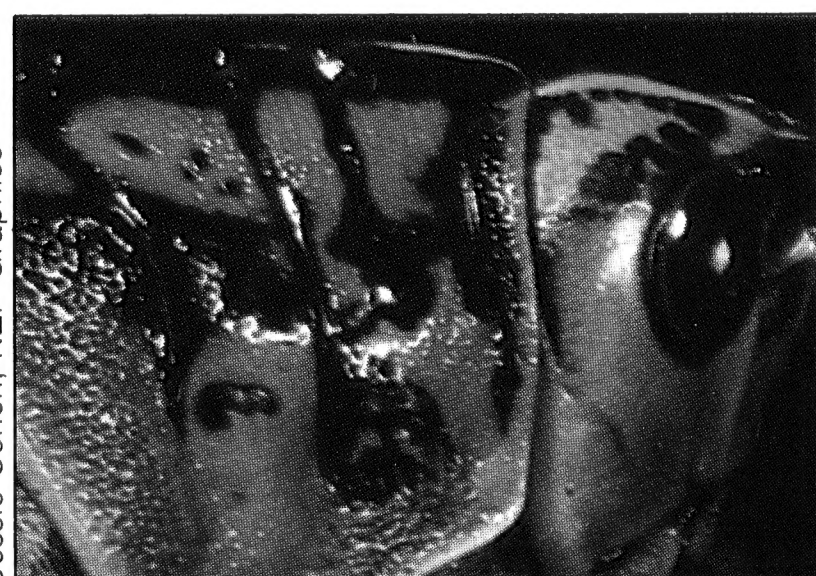
Michael Robinson, Director
National Zoological Park



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Red panda (p. 4)



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Giant panda (p. 16)

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Species Survival Plans: Blueprints for the Future

Jake Page

Of the hundreds of species housed at the National Zoo, 15 are referred to, often in tones of pride and even reverence, as "SSP animals". SSP stands for "Species Survival Plan," a carefully mapped, cooperative, inter-zoo program that targets certain captive species for intensive research and expanded propagation.

An excellent idea, of course—but why aren't all zoo animals so designated? To ask that is to plunge into the midst of one of the boldest, most positive developments in the world of zoos since the first modern one opened in London in 1826. At that time, Regent's Park was considered modern because of its enlightened aims: popular entertainment supplemented by research and education. Today zoos have added even more complex goals. Through SSPs, a network of American zoos is taking direct action to increase the

global captive population of 36 threatened species. Within the framework of the American Association of Zoological Parks and Aquariums (AAZPA), a number of leading U.S. zoos serve as bases of operations for one or more SSP species, managing as a single population the animals of that species that live in zoos around the country (see chart, below).

Throughout the short history of zoo-based animal preservation efforts, the National Zoo has been especially graced. After all, among the Zoo's founding "members" was a pair of bison that became emblematic of an early—and ultimately successful—effort to preserve a vanishing American species. Furthermore, as part of the Smithsonian Institution from its birth, the National Zoo also inherited a certain kind of useful fanaticism common to museum people: keeping records. As it turned out, this obsession with record-keeping was crucial to the development of the Species

Survival Plans, as was another of the National Zoo's traditions—that of being part of an institution devoted to research.

Alternatively, one might trace the origins of the SSPs to a pair of enthusiastic amateurs—in fact, to two people with very peculiar hobbies.

The first, an army man named Marvin Jones, was a zoo fan who visited many of the world's great zoos while traveling on military business. Not

Unable to adapt to human encroachment, the lion-tailed macaque of southern India (right) is the most seriously jeopardized macaque species and one of the most critically endangered mammals in the world. (Photo by Jessie Cohen, NZP Graphics.)

Survival Plan Species

SSP captive management programs are currently in effect for the 36 species listed below. (Species listed in bold print are on exhibit at the National Zoo.)

Arabian oryx (*Oryx leucoryx*)
 Aruba Island rattlesnake (*Crotalus unicolor*)
Asian elephant (*Elephas maximus*)*
Asian lion (*Panthera leo leo*)*
Bali mynah (*Leucospa rothschildi*)*
 Barasingha (*Cervus duvauceli*)
 Black lemur (*Lemur macaco*)
 Black rhinoceros (*Diceros bicornis*)*
 Chacoan peccary (*Tayassu pecari*)

*NZP staff involved in SSP
 †SSP coordinator at NZP

Cheetah (*Acinonyx jubatus*)*
 Chinese alligator (*Alligator sinensis*)
 Gaur (*Bos gaurus*)*
Golden lion tamarin
 (*Leontopithecus r. rosalia*)*†
Gorilla (*Gorilla gorilla*)*
 Grevy's zebra (*Equus grevyi*)
 Humboldt's penguin (*Spheniscus humboldti*)
Indian rhinoceros (*Rhinoceros unicornis*)*
Lion-tailed macaque (*Macaca silenus*)*
 Madagascar ground boa
 (*Acrantophis dumerili*)*
Maned wolf (*Chrysocyon brachyurus*)*†
 Okapi (*Okapi johnstoni*)
Orangutan (*Pongo pygmaeus*)*
 Orinoco crocodile (*Crocodylus intermedius*)

Przewalski's horse (*Equus przewalski*)*
 Puerto Rican crested toad
 (*Peltophyrne lemur*)
 Radiated tortoise (*Geochelone radiata*)
Red panda (*Ailurus fulgens*)*†
 Red wolf (*Canis rufus*)
Ruffed lemur (*Lemur variegatus*)
Scimitar-horned oryx (*Oryx dammah*)
 Siberian tiger (*Panthera tigris altaica*)
Small-clawed otter (*Aonyx cinerea*)*
 Snow leopard (*Panthera uncia*)
 Sumatran rhinoceros
 (*Didermoceros sumatrensis*)*
White-naped crane (*Grus vipio*)*
 White rhinoceros (*Ceratotherium sinu*)





An SSP Success Story

In January 1987, one of the Zoo's three pairs of Oriental small-clawed otters (*Aonyx cinerea*) produced and successfully reared a healthy litter of pups. This SSP success story also marked a first in the history of the National Zoo. While two other small-clawed otter pairs have given birth, this year's offspring are the first to survive beyond the third month of life.

Currently on display in the Small Mammal house, the new family has far-flung "roots." The father, Shane, was born in 1983 in the Rotterdam Zoo and came to NZP via the Bronx Zoo; Shane's mate, one year his junior, was raised by a private breeder in Great Britain. Shane has sired one previous litter, but his current mate gave birth for the first time.

The Beaver Valley and Monkey Island otter exhibits seem to offer more in the way of space and hospitable denning areas, so we were happily surprised by the birth of two healthy male pups in the indoor Small Mammal exhibit. Concerned by the apparent lack of privacy, we briefly considered pulling the pups for hand-rearing, but quickly changed our minds when the parents began a vigorous defense of the nesting area, indicating their willingness to care for the pups.

Indeed, both adults have proven to be excellent parents and were seen teaching the cubs to swim as soon as they emerged from the nest. The pups grew quickly and at five

months of age, nearly matched their parents in size.

We hope that the parents will produce a second litter this fall, extending the family group. By helping to raise younger siblings, the first-generation offspring should learn the skills they will need to become able parents themselves.

Small-clawed otters are not considered to be rare in the wild, but captive breeding efforts in the U.S. have met with mixed success. Of the 13 American zoos exhibiting the species, only five zoos and one private breeder have produced young, and only four have successfully raised them. For this reason the Oriental small-clawed otter was designated an SSP species; by working together, researchers hope to refine captive husbandry techniques. The small-clawed otter SSP Committee of the AAZPA meets once a year to discuss improvements in the species' management, share successes, and engage in a bit of highly scientific matchmaking. The lot of small-clawed otters in captivity is slowly improving, with successful births occurring at the Bronx and San Diego Zoos as well as at NZP.

The growing small-clawed otter family can be viewed daily in the Small Mammal House. The animals are most active between 9 and 11 a.m. and 2:30 and 4 p.m.

—William Xanten
Collection Manager

content merely to visit, Jones began to record genealogies in zoos. In the late 1960s, for example, he began a full-scale studbook for a small monkey, the golden lion tamarin. After retiring from the military, Jones went to work for the San Diego Zoo. In a sense, Jones's work inspired another zoo enthusiast who at the time worked in a veteran's hospital. This man, Ulysses S. Seal, began an even more ambitious genealogical effort which, in 1973 became known as the International Species Inventory System (ISIS), a computerized record of the parentage, sex, location, and transfer or eventual death of each animal in most of the world's major zoos. ISIS (an acronym that spells the name of the Egyptian goddess of fertility) gets a large part of its support from the AAZPA and is housed at the Minnesota Zoo. Some 220 zoos, including about 80 percent of those in the United States, regularly feed a computer in Minneapolis with data on births and acquisitions from the wild.

Before ISIS no such documentation existed except for a few studbooks on a handful of species. Most zoos did not keep such records even for their own use. The National Zoo, however, had been doing this all along. Since the 1960s, NZP Registrar Judith Block had insisted so relentlessly upon the keeping of precise records that the practice became a matter of rote for the Zoo's animal managers. The computerized system used to keep track of all this by ISIS was developed partly out of the experience and standards set at the National Zoo.

In the meantime, three members of the Zoo's research staff had undertaken an investigation that dramatically illustrated the value of meticulous NZP/ISIS-style record-keeping: NZP scientist Katherine Ralls, with the help of students Kristin Brugger and Jonathan Ballou, analyzed the records of ungulates at the National Zoo over the years and generations, seeking to learn if there was a correlation between juvenile mortality and inbreeding. The study included a number of deer and antelope species along with zebras, pygmy hippos, and elephants. At the time, inbreeding was generally assumed to be a malevolent force in animal populations, but lack of records and lack of specialized scientists—like population geneticists—on zoo staffs had tended to

mask the problem unless it erupted in obvious, visible birth defects. Nonetheless, it was clear that in the small and exclusive populations of zoos, inbreeding was a common necessity.

The study by Ralls and her colleagues was published in 1979 in *Science*. The results shocked the zoo world. In 15 out of 16 species, juvenile mortality was greater among inbred offspring. The inbred young died or became ill at a much higher rate than non-inbred young. Inbreeding, it seemed, was a silent stalker of small populations—perhaps, it was speculated, even small populations in the wild.

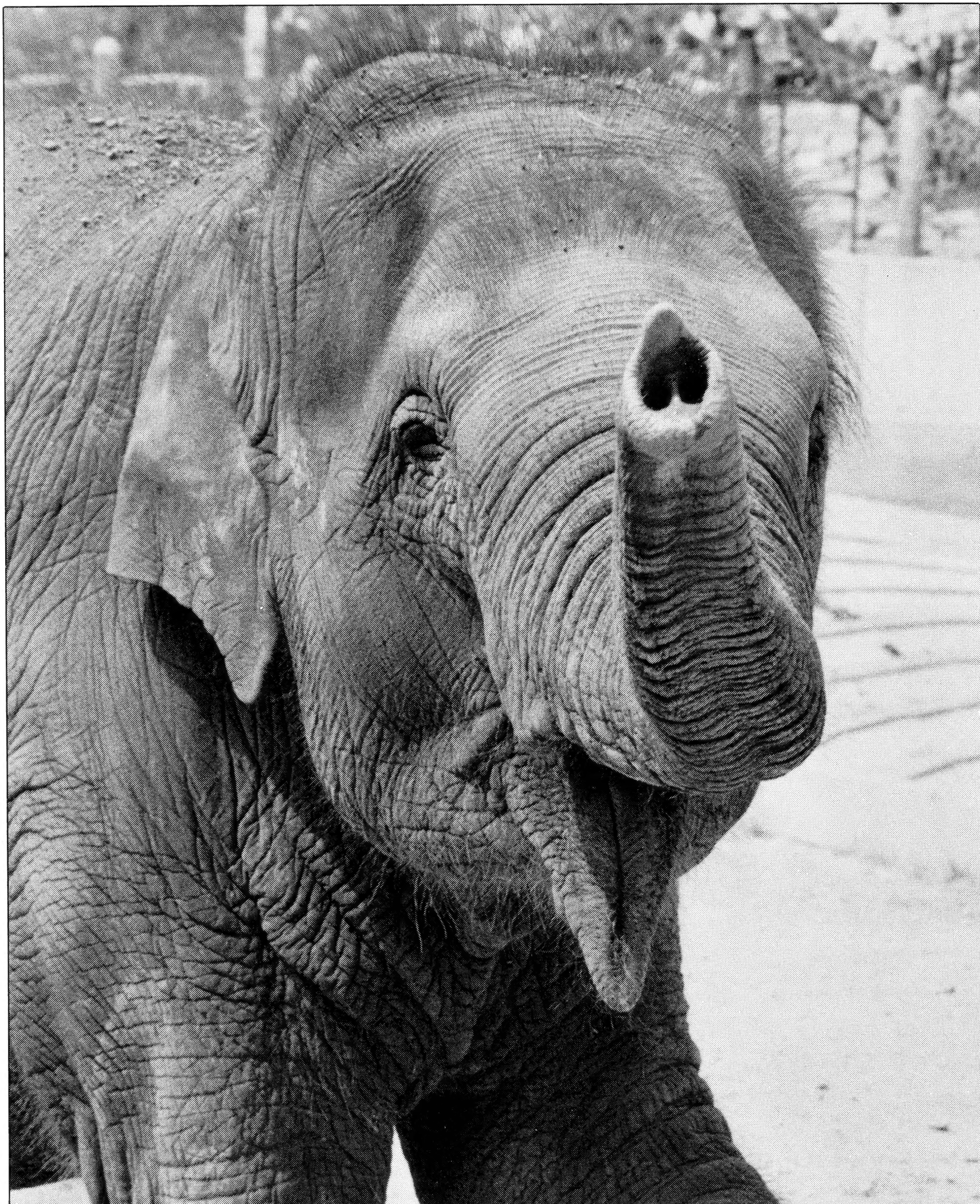
Ralls extended these analyses to 44 mammal species in several U.S. zoos and found that 41 of them (93 percent) suffered higher juvenile mortality when inbred. Furthermore, the study showed that a variety of “hidden” congenital defects were prevalent among inbred groups, and continued study revealed that inbreeding also served to lower fecundity.

Obviously, a new approach was in order. Compelled by these sorry findings and by a growing awareness of the need to become more effective at breeding many endangered species that could no longer routinely be obtained from the wild, zoos inaugurated an unheard-of era of cooperation. One zoo’s herd of zebras, for example, might be relatively small, making inbreeding inevitable, but the collective zebra population of all zoos was much larger. Clearly, inter-zoo management of populations was the best way to avoid the ravages of inbreeding. Thus, in 1980, an AAZPA committee that included the National Zoo’s senior scientist, John Eisenberg, gave birth to the idea of Species Survival Plans.

With all of the endangered species in the world, it would seem almost



Right: The secretive South American maned wolf is sometimes mistakenly perceived to threaten livestock. Hunted as pests and suffering from the destruction of grassland habitat, maned wolf numbers are declining. Above right: Relatives of the ubiquitous starling, fewer than 60 Bali mynahs remain in the wild. (Photos by Jessie Cohen, NZP Graphics.)



impossible to establish a set of criteria for choosing which species should and should not receive the preferential treatment of an SSP. The chief criterion, of course, is that the species be imperiled in the wild, and its case is given more weight if it is the only example of its genus or family. This still leaves a long list of candidates, but practical considerations tend to shorten it.

First of all, the probability of successful captive breeding should be high. There must also be an able and willing group of professional people from a number of zoos granted the time and financial support to work on the species chosen. And finally, there must be information. Lots of information.

Once a species is selected for high-priority treatment, managers from the zoos that maintain it appoint an overall coordinator whose task, among others, is to maintain current data for the species' studbook. Next, an overall plan is developed—a blueprint for survival. The general strategy is the same: pinpoint a diverse group of founders, increase the species' population to the carrying capacity of the zoos involved, and carefully monitor the population thereafter. But individual SSPs vary considerably, depending on such factors as the age of the present founders, the availability of the animal in the wild, and the overall size of the captive population. The equations are further compounded by variations in the biology of the species involved—for example, breeding ages,



Since 1970, 84 percent of the world's rhino population has disappeared due to habitat loss and trade in rhino parts, particularly horns. Numbering three to four thousand, the white rhino (left) is the most secure of all rhino species. It breeds well in captivity and populations are fairly stable in protected wild areas. (Photo by Bruce Vlohiotis.) Above left: As the Asian elephant's habitat is cleared for development, conservationists are urging funding agencies to include natural elements in project plans. (Photo by Jessie Cohen, NZP Graphics.) Right: The large captive population of endangered orangutans now boasts first and second zoo-bred generations. (Photo by Jessie Cohen, NZP Graphics.)

reproduction rates, lifespans, space needs, etcetera, will obviously be different for bird, reptile, and amphibian species than they are for mammals. Most importantly, each SSP must take shape around its ultimate goal.

By definition, that goal is survival, but survival where? For some species, the idea is to breed animals in captivity for an early release to the wild. Other, newly acquired species may face a fairly long-term stint in zoos. And in a few cases, when a species' habitat is gone for good, its destiny may be permanent captivity.

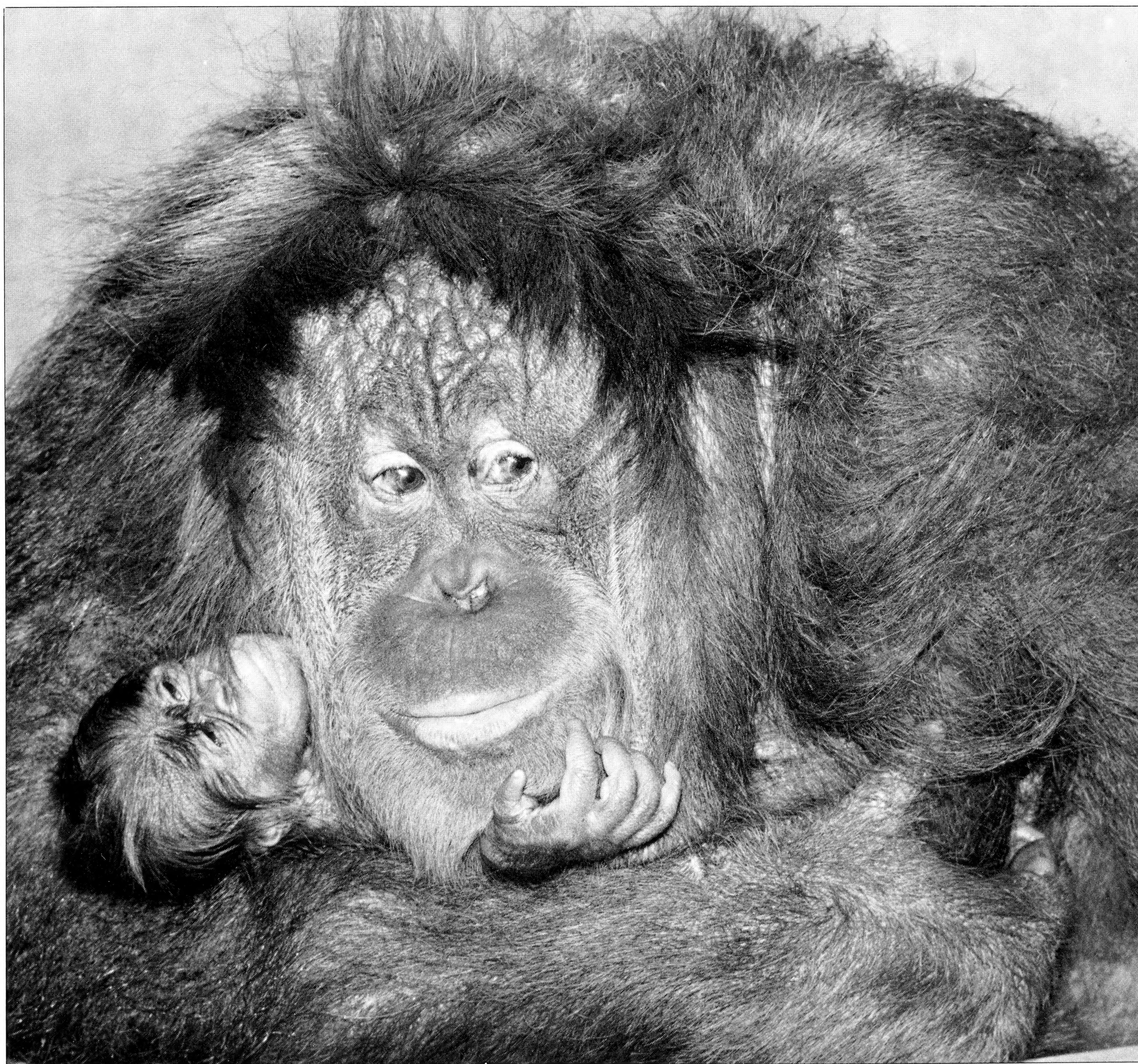
Today there are 36 species in Species Survival Plans, although only

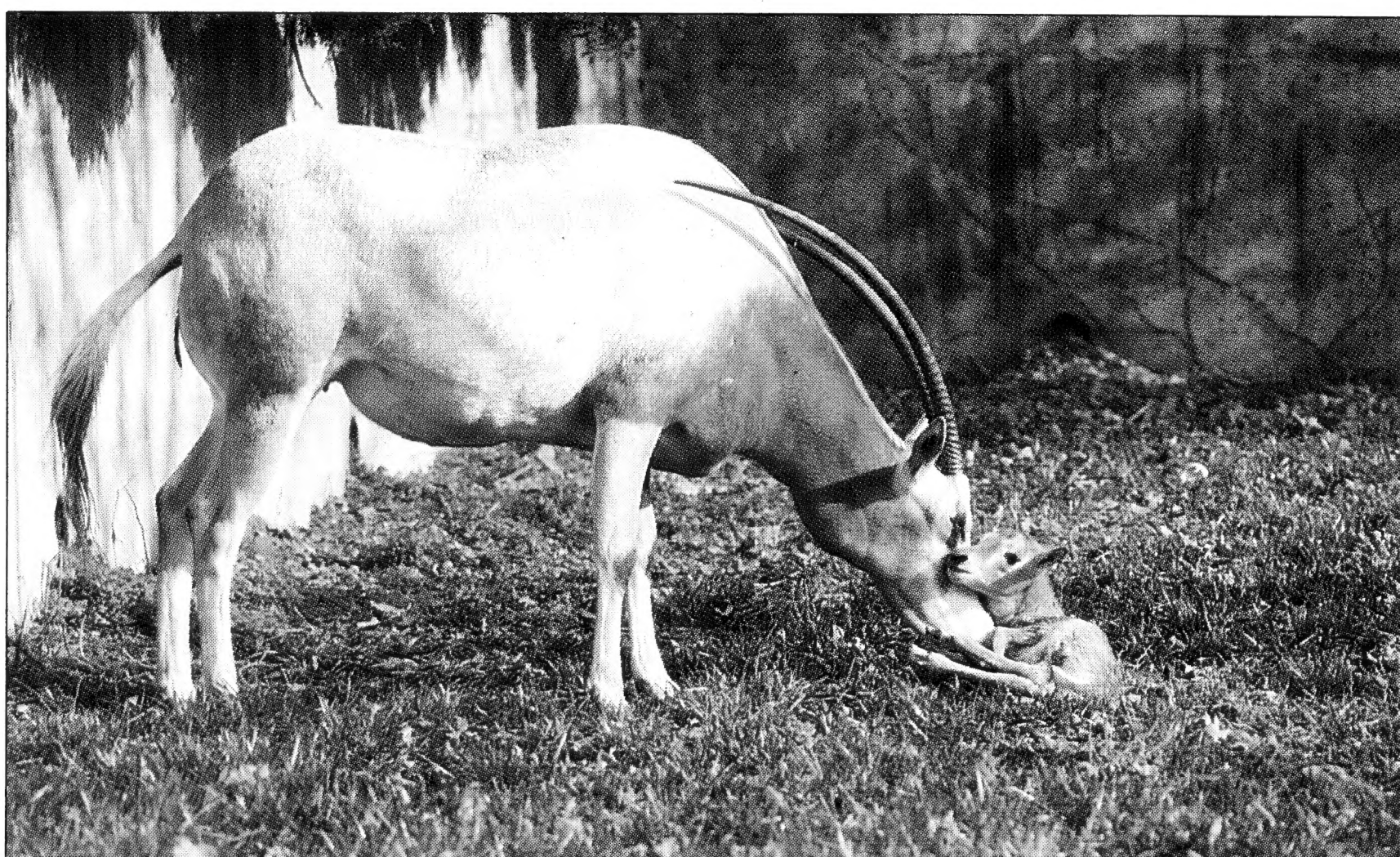
about 10 enjoy thoroughly worked out strategies. Of the 14 SSP species at the National Zoo, three are under the direct management or coordination of Zoo staffers.

The best known SSP story at the Zoo is that of the golden lion tamarin. For several years the tamarin studbook and SSP were guided by Devra Kleiman, head of the Zoo's research department. Currently the acting studbook keeper is Jon Ballou, one of the original researchers in the Ralls study. Ballou also serves as the Zoo's overall Population Manager, a position that in itself speaks volumes about the progressing sophistication

of zoo management. In the case of the tamarins, one goal was to reintroduce some animals to the wild, therefore the strategy was to breed the population up to carrying capacity as quickly as possible from as many founders as practical and then slow the reproductive rate down. This would allow the development and maintenance of a high degree of genetic diversity.

The broad-based techniques of scientific management devised for the tamarin SSP have become something of a model for the others, including the highly successful effort currently underway for the red panda (see *Zoo-Goer*, Nov.-Dec. 1986) under the





guidance of the Zoo's Miles Roberts.

The third SSP species managed at the National Zoo is the maned wolf, a secretive canid of the South American grasslands. Long-legged, long-tailed, with a fox-like face and large, alert ears, the maned wolf was studied intensively by NZP scientists in the field and at the Zoo; in 1984, it was designated an SSP animal. One of only 17 captive maned wolf populations in the United States, the Zoo's animals have thrived since 1974 under the nearly parental devotion of Melissa Rodden. A decade later her hard work was rewarded: A species coordinator was needed and Rodden, a biotechnician, was so designated. Usually, Rodden explains, "an SSP coordinator is a curator." Most of Rodden's days are spent at the Conservation and Research Center in Front Royal, where the maned wolves have proved successful breeders—usually yielding two to four pups per litter. However, in captivity the shy wolves are not particularly assiduous parents, so the young are frequently raised by volunteers at the Zoo's Rock Creek Hand-Rearing Facility.

Like every SSP, the maned wolf program requires a blend of the theoretical and the practical. The size of the current breeding population ensures a healthy degree of genetic diversity among maned wolves . . . yet a practical problem remains: The elusive maned wolf is not an ideal exhibit animal, so Rodden must spend time persuading other zoos to take on populations of these animals.

Population geneticists in America and abroad have begun to develop computer programs for looking into the past pedigrees of animals in captivity to project when and which genes

Top left: All but extinct in the wild, the rare Przewalski's horse was recently returned to its native Central Asian desert by Russian zoologists. A herd of 12 Przewalski's horses, including a foal, is maintained at NZP's Conservation and Research Center. Center left: A team from the National Zoo recently reintroduced a third group of golden lion tamarins into the Atlantic coastal forest of Brazil. Bottom left: The National Zoo reached a milestone in the summer of 1986 with the 100th birth of a scimitar-horned oryx at the Conservation and Research Center. (Photos by Jessie Cohen, NZP Graphics.)

of past founders will disappear from the population. They try to formulate mathematical rules of thumb for how large a captive population must be to retain its genetic diversity over time. Working within these guidelines and constantly incorporating insights from new data on SSP species, the coordinators of SSP plans find themselves framing and adjusting genetic and geographical tactics in front of their computer screens. A task this complex—deciding who shall mate with whom and who shall live where—relies less on instinct than on the technological know-how of the match-maker.

SSP requirements have also given added urgency to the application of sophisticated medical techniques. Health care takes on added meaning when you are the individuals responsible for the health of a small population that may represent the best hope for a species. In keeping with the traditions of the place, the Zoo's clinical and pathology staffs have long maintained detailed records of health and disease among the Zoo's collection and these records themselves have been an important plank in the structure of many SSP plans.

NZP veterinarian Mitchell Bush and pathologist Richard Montali have pioneered techniques for diagnosis and disease prevention in exotic animals—not just for SSP species managed at this zoo but for others as well. Such preventative techniques are never more crucial than when a captive population is about to be reintroduced into the wild. In addition, their discovery and characterization of disorders such as cystinuria in maned wolves and defects among the golden lion tamarins have made important differences in SSP breeding strategies because of the possible



Right: The endangered white-naped crane of Asia is a member of one of the oldest groups of birds. Found on every continent except South America and Antarctica, cranes will return to the same breeding grounds year after year unless human disturbance alters the terrain. Above right: The National Zoo's red panda breeding efforts have boomed since the first litter was raised to adulthood in 1972. NZP now leads the zoo world in the number of successful red panda births. (Photos by Jessie Cohen, NZP Graphics.)



genetic causes of these conditions.

Even more elaborate biomedical techniques have been called into play. Bush, NZP reproductive biologist David Wildt, and geneticist Steve O'Brien of the National Cancer Institute have used the techniques of artificial insemination, *in vitro* fertilization, and embryo transfer in exotic species—"technologies" which not only are of obvious value for individuals that are poor breeders but also provide alternatives to the expensive and often hazardous business of shipping animals from one place to another. Their work also includes sophisticated blood tests conducted by electrophoresis, in which certain structural proteins of the blood can be analyzed to show precisely how closely related several animals may be. In monitoring the genetic diversity of a captive population, this is like having a scalpel rather than a chisel.

Such techniques and tests are proving invaluable for SSP animals. Through precise genetic analysis, NZP researcher Lisa Forman determined that the captive population of golden lion tamarins was more genetically variable than the remaining wild animals; Ned Gentz of the University of New Mexico confirmed that there are two subspecies of red pandas; and an NZP team learned that much of the Asian lion population in U.S. zoos is significantly "tainted" with the genes of African lions. Without this information, years of expert time and effort might well have been wasted.

Thus, when you hear that an animal is an SSP animal, it means that the best minds and the best science available to the entire zoological community have been brought to bear on that animal's behalf. Its chances of survival—whatever they may have been ten years ago—are far, far better. □

Left: Asian lions once ranged from Greece to northern India, but now survive only in the Gir forest, a reserve in India's Gujarat State. Above left: Unlike other lemur species, in which young cling to their mothers during early life, the female ruffed lemur raises her young in a nest and carries them from place to place in her mouth. (Photos by Jessie Cohen, NZP Graphics.)

Scarce Resources & Endangered Species

Michael E. Soulé

A few flagship species are, today, receiving the lion's share of the funding. Is all the attention on a handful of endangered species really justified? I am often asked this question by sincere conservationists who are concerned with the apparent favoritism that is lavished on a few charismatic or cuddly animals, such as the peregrine falcon, the California condor, the black-footed ferret, the giant panda, the various rhinos, and other large vertebrates.

My usual, pat answers went something like this: I don't see a real problem with singling out a few species for special attention. Granted, it is undemocratic, perhaps even feudalistic, to grant special stays and dispensations to a few courtier species that happen to enjoy our condescension. But we must look at the alternatives, and try to enumerate the advantages and disadvantages of this interspecific cronyism.

One justification for the present system, the "keystone principle," is that the favored species are often large animals, and therefore are keystone predators of major herbivores. There is increasing evidence that their disappearance from a community can initiate serious ripple effects. The propagation of these effects can lead to major changes in the interaction of species, and to disappearances of entire guilds such as ant-following and ground-nesting birds in the tropics and early successional stages (such as those created by browsing).

A second argument, also ecological, is the "umbrella argument;" it goes like this. Yes, the tiger and grizzly get special attention, but look at the benefits. These large, generalist animals require a lot of space and lots of habitat diversity. In addition, if our objective is to make a park or nature

reserve that is large enough to hold a minimum viable population of these species, it must be huge—thousands of square kilometers in most cases. Therefore, a "trickle-down" effect of these space-intensive species is to provide a lot of habitat for other, less attractive species—species that need protection, but which lack sex appeal.

An implied assumption made by those who would support a more egalitarian allocation of scarce conservation funds is that if the funds were not spent on condors or tigers, they would be available for kangaroo rats, lizards, and rare plants and insects. Is it true? Often it isn't. It is a principle of fund raising that money that is given for one cause is not necessarily available for other, similar causes. This could be called the "niche theory of giving." That is, the people who contribute to Greenpeace to save baby seals and to the WWF to save pandas, won't give to buy hectare of tropical forests or to support research on endangered snakes, and vice versa. The implication is that there isn't much we can do about democratizing conservation. So, we might as well spend the money on those species that are lucky enough to attract it.

Another principle of fund raising tends to soften the blow, however. This could be called the "cornucopia rule"—there is plenty of money out there; it is simply a matter of identifying the "universe" of donors who are interested in your cause, and then making the correct pitch. Indeed there are societies to save endangered bats, fishes, and insects.

Adding all this up, it was easy to convince myself that one shouldn't be alarmed by conservation elitism. But now I'm not so sure. Let's re-examine the preceding arguments.

First, there are many species that don't profit from the keystone principle. The reason is that many charismatic species are really not ecological keystones. For example, the disappearance of condors, peregrines, whooping cranes, and even grizzlies from many regions would have very little impact that could not be dampened by counterpart species. Second, the trickle-down or umbrella effect,

the *noblesse oblige* of animal emperors, really doesn't confer benefits on many smaller, threatened taxa. Many threatened species are habitat specialists whose ranges don't happen to coincide with those of their charismatic "benefactors."

Second, there are many species that require more than just space—they need special management interventions such as improved nesting or denning sites. Other species must depend on management for the control of diseases, control of competitive or predatory exotic species, control of hydrological variables, or protection from humans. The world is so disturbed in many places that mere benign neglect is of little or no help.

Third, the cornucopia rule has only limited validity. It fails altogether in government agencies where funds are definitely finite, and where money spent on species A diminishes the pool of dollars for species B, C, and D. This can be a source of great anguish for many dedicated biologists in state and federal agencies, who must take from B in order to give to A, and who must risk the alienation of their colleagues in the process.

So, I am not so flippant about the supposed benefits and inevitability of our current caste system. But I don't know what to do about it.

One of the unspoken rules for the essayist is to always end on a positive, constructive note. I'd like to, but it would be premature. Perhaps it is time, though, to turn up the volume on this dialogue. □

Dr. Soulé is president of the Society for Conservation Biology. He recently completed a Smithsonian Regent's Fellowship in Biology at the Zoo's Department of Zoological Research. This article is reprinted with permission from Endangered Species Update.

Overleaf: The lubber grasshopper of the southeastern U.S. is an example of species interdependence in healthy ecosystems. Distasteful to the usual grasshopper predators, the lubber population is held in check by a species of fly that lays its eggs on the lubber nymphs. As their host matures, the fly maggots literally eat the grasshopper from the inside out. (Photo by Jessie Cohen, NZP Graphics.)





Inside Panda Watch 1987:

Nell Ball

Everybody watches pandas, the indisputable stars of the National Zoo. People will wait for hours, packed shoulder to shoulder in the Panda House, cameras at the ready, hoping that a sleeping panda will do something—anything—but continue to sleep. The slightest movement, even a scratch, brings cheers and the popping of flashbulbs.

But tourists are not the only people who watch pandas. Fifteen years after the panda pair's arrival, National Zoo staff and volunteers continue to watch Ling-Ling and Hsing-Hsing for a variety of reasons. As part of the daily routine, panda keepers watch their charges for signs of injury or illness, reactions to weather conditions, changes in activity patterns that may signal the onset of estrus in the

FONZ volunteer Nell Ball has been watching the pandas since their arrival in 1972 and has coordinated panda watch recordkeeping since 1982. Active in a range of NZP behavior watch programs, she also serves as house guide for the Small Mammal House.

female, and so on. Between 1972 and 1981, both animals were the subject of all-night behavior studies, and researchers still spend several months each year collecting data in the Panda House, especially during the breeding season. But to many Washingtonians, the term "panda watch" is synonymous with "preg watch," and this is most true for the volunteer watchers themselves.

A handful of watchers have been following the ups and downs of the panda pair for years, while new recruits continue to sign on at the start of each successive panda birth season. But for veterans and newcomers alike, the 1987 watch was one of a kind—a rollercoaster ride of emotions that ranged from exhilaration to deep disappointment.

The 1987 "preg watch" was officially launched at 10 a.m. on June 15. Two days earlier, a mass orientation had been conducted to prepare the 85 volunteers for the work of the weeks ahead. By now such briefings have become ritual: Sample data collection sheets (checksheets) and instructions

for recording behavior are distributed, volunteers are briefed on the use of video equipment, Zoo staff members are introduced, openings on the watch schedule are filled, questions are answered, and logistics are discussed. Excitement always abounds at these initial gatherings, and this year proved no exception: News of Ling-Ling's apparent good health and record number of successful copulations lent an air of optimism to the proceedings.

Logistics are a consideration in any behavior watch, but when a program runs around the clock, week in, week out, details must be planned to the letter. How will watchers contact Zoo police to gain entry to the Park at 3 a.m.? Where will daytime watchers park when nearby lots are full? Who is to be called in case of equipment failure? What's to be done when the Panda House kitchen—the base of watch operations—floods during a heavy rain? (Don't leave anything on the floor, and open the door so the water runs into the bathroom and down the floor drain!) Yet no matter how many questions are considered,

Giant Panda Dateline

March 3 and 4: Allowed greater access to each other than in previous breeding seasons, giant pandas Ling-Ling and Hsing-Hsing mate a record seven times.

June 2: Analysis of urinary hormones performed at Rockefeller University's Population Council and NZP's Conservation and Research Center indicates that Ling-Ling may be pregnant. Preparations are made for the arrival of a cub.

June 8: Ling-Ling goes off her morning food and continues to show a decreased appetite—one cue to an impending birth.

June 15: Panda watch begins. Keepers maintain Ling-Ling's normal routine and allow her continued access to the outdoor yard.

June 17: Ling-Ling builds a small, crude nest.

June 20: As Zoo visitors look on,

Ling-Ling builds a large nest of bamboo branches.

June 23: Observing Ling-Ling via TV monitors, panda watchers see the first signs of labor at 12:58 a.m., followed by the first strong contraction at 1:59 a.m. An infant cub is born at 3:33 a.m. Ling-Ling immediately begins licking and cradling the cub and continues to tend it closely in the days that follow.

At 3 p.m., a panda keeper discovers the body of a second, undersized cub in the nest. Review of videotapes suggests that this cub was probably born shortly before its female twin.

June 24: Ling-Ling carries the live cub out of the exhibit area and into the adjoining den, enabling Zoo staff to retrieve the dead cub. A subsequent autopsy reveals that the cub—an 85-gram male, about 2/3 the size of an average newborn—took a few breaths

but was never heard to vocalize and died from lack of oxygen shortly after birth. The infant is found to be free of infection, however, raising hopes for the health of the surviving cub. (Pandas commonly give birth to twins, but there are no recorded cases in which both cubs have survived). All appears to be well.

June 26: Cradled in its mother's arms, the cub vocalizes periodically throughout the evening. The last vocalization is recorded at 11:41 p.m. At 11:56 p.m., Ling-Ling puts the cub down and leaves the den. The infant fails to cry out, arousing concern among Zoo staffers.

June 27: At 12:05 a.m., Ling-Ling returns to the cub, which she licks and cradles. The cub remains silent and motionless. Ling-Ling again leaves the cub when given access to her outdoor yard at 1:43 a.m. Chief Veteri-

Behind-the-Scenes Report

new and unexpected complications inevitably arise.

This year, for the first time, Ling-Ling had access to areas beyond the range of the closed circuit television cameras. To keep her in sight, observers found themselves moving from the kitchen to the public area of the Panda House, to the building's roof and back again. This made life difficult, particularly if an on-duty watcher was not in the kitchen when his or her relief arrived at the locked door. To solve that problem, signs reading "Roof" or "Bldg" were placed outside the kitchen door to indicate the watcher's whereabouts. Unfortunately, the "Roof" sign lasted about two days, since visitors reasonably assumed that it pointed the way to the rooftop snack bar. When the door failed to open, people would knock and rattle the knob, interrupting the keepers' work.

Mastering the training, coping with distractions, straining to stay awake at two in the morning when Ling-Ling hasn't moved for an hour and even the mice are asleep—these things must

become second nature to the entire volunteer team if any given member is to alert Zoo staff to an imminent panda birth. Of course, watchers have mixed feelings about this most important function: Everyone longs to witness the actual birth but can't help feeling nervous at the prospect of making the decision that THIS IS IT. Suppose he or she misses crucial behaviors or misinterprets activities—or gets somebody out of bed in the middle of the night for a false alarm? What if the birth occurs so suddenly that nobody else can arrive in time and the volunteer must make observations, collect data, and run the recording equipment single-handed? The possibilities seem endless, but with the exception of a few false alarms, none of these scenarios has ever occurred.

This year events leading up to the big moment went like clockwork. Alert volunteers on duty the evening of June 22 made precisely the right decisions based on Ling-Ling's behavior and placed the all-important first phone call in ample time to set the

Zoo machinery in motion. As was the case in 1984, the volunteer on duty at the time of the birth was a new watcher doing his first solo shift.

With the birth of a live cub at 3:33 a.m. on June 23, the delighted observers immediately shifted gears and began to track mother-infant interaction. This new watch posed its own set of difficulties: How could you record behavior when Ling-Ling had her back to the camera or was cradling the infant out of sight under her arm? Did you call the cub's vocalizations screeches or squeals and what seemed to provoke them? Instructions were changed almost hourly.

The following morning, June 24, Ling-Ling moved herself and the cub out of camera range, forcing volunteers to rely on the "soundtrack" for information. A new microphone was quickly installed just outside the door to her den, and instructions were revised once more. Still, spirits were high, and nobody seemed to mind the difficulties. For the watchers, anticipation of the birth was replaced with

(continued on page 21)

narian Mitchell Bush removes the dead cub. At 2:30 a.m. NZP Pathologist Richard Montali begins an autopsy of the five-ounce female infant.

Postscript: Having come so close and yet so far, isolation of the cause of death becomes essential if panda breeding efforts are to continue. This year, the Zoo's Pathology team developed and used sophisticated new techniques to pinpoint the cause and track the course of the fatal infection. It appears that the cub ingested certain staphylococcal bacteria from the mother's nipple area or through her milk. The bacteria entered the bloodstream and reached the liver, triggering the blood clotting mechanism. This resulted in serious liver impairment and the subsequent death of the cub.

Many readers will recall that Ling-

Ling's previous two offspring succumbed to infections acquired *in utero* (before birth). However, the 1987 female cub died of an infection acquired *after* birth, despite the hygienic precautions taken and exhibit modifications carried out in response to the experience of previous years.

The type of staphylococcus ingested by the cub is similar to bacteria found on the skin of healthy domestic carnivores, but even in such animals, these bacteria can cause disease if heavy exposure occurs. Tests revealed that the cub did receive some antibodies through her mother's colostrum or first milk, but enough of these antibodies may not have been absorbed to ward off the infection.

Exploring the question of the cub's death goes beyond pure scientific interest, for the answers suggest several possible actions that could

make the critical difference should another birth occur. Options under consideration include imposition of even more stringent hygiene standards that would reduce Ling-Ling's bacteria population without restricting her current freedom and further exhibit modifications which would render her den area more impervious to bacterial contamination. The use of prophylactic antibiotics in Ling-Ling and/or the administration of a purified, concentrated form of antibodies to a future newborn are also within the realm of possible measures that could be taken. Once final decisions are made by Zoo staff, preparations will begin, so that changes to the enclosure or in the daily routine will have become a matter of course for Ling-Ling and those who care for her by the time next spring—and the next panda season—rolls around. □

A Day in the Life Of a Keeper-Volunteer

Susan Weinberg

The kinds of chores you postpone at home take on a never-imagined charm when you find yourself doing them for a chattering family of small monkeys or an elegant red panda. So I discovered first-hand during my early days as a volunteer mammal keeper at the National Zoo's Conservation and Research Center (CRC) where approximately 39 species of rare animals are bred and studied at a 13-year old, 3200-acre "farm" in Front Royal, Virginia.

The three-month minimum keeper-volunteer stint has been called "summer camp for animal lovers" by one former CRC volunteer; it is also serious, demanding, and muscle-straining work. Teamed with professional keepers until the various routines are learned, a typical new recruit might have a Monday like this one:

7:30: The keeper staff gathers in the Center's Commissary Building, a converted grain elevator now stocked with canned, frozen, and fresh animal food.

Gearing up for the morning rush to check and feed their charges, keepers brief each other on weekend developments in the animal collection, while keeper foreman Art Cooper sends volunteers either to work in one of the small mammal buildings or out to pasture with the hoofed stock crew.

7:45: This morning I'm teamed with keeper John Watson-Jones,

whose previous experience "downtown" at NZP and at the San Francisco Zoo led him to a job at the Conservation Center in 1983. Our first stop is the Center's gleaming new animal hospital, where Quimby, a tree kangaroo recently arrived on breeding loan, is in routine quarantine. Plastered with airline stickers, Quimby's empty "sky kennel" is on the floor, tagged with a form detailing his old diet. No effort has been spared to smooth his transition: Lights were left on overnight so Quimby wouldn't be alarmed upon waking in an unfamiliar place, and keepers have outfitted even these temporary quarters with a roost of interlocking limbs and branches. Resting in the comfortable crotch of a "tree," Quimby gazes down with mild interest as his food and water pans are changed, oblivious to the great expectations held for his breeding success.

8:10: As the key turns in the lock to the Small Animal Facility's mammal wing, vines start to shake and rattle. Black Goeldi's marmosets shoot out of nowhere, landing on the mesh front of their large enclosures. Between the chorus of animal cries and the sunlight that streams through this humid solar building, it seems we have stepped out of the winter wind and into a tropical oasis. All down the line, animals scamper to their doors to investigate, chirping and calling in anticipation of a favorite morning ritual—the bribe.

"These treats help us get a good,

close look at each animal," says John. "See if anyone's been bitten or taken sick overnight." We offer raisins to the families of marmosets and golden lion tamarins, who use their tiny hands to steer my fingers their way. Next we visit the fanaloka (a member of the mongoose family), the yapoks (Central American water possums), and the deceptively sweet-faced tiger quolls, who dash from hollow logs, toothy jaws snapping at the air. Finally we give celery to the tree kangaroos, whose enthusiasm for this vegetable belies their pot-bellied silhouettes.

9:10: Cage cleaning is next. While John hoses down the bare floors of the tree kangaroo enclosures, I strike out on my own with a plastic-lined bucket and a metal scraper.

The animals keep a close watch as I move around their turf. Unlike their zoo counterparts, these animals see only a few familiar faces every day so a newcomer arouses great curiosity: Entering an enclosure is to discover yourself suddenly center stage, as a mother-daughter pair of tree kangaroos huddles together as if plotting overhead, or a tireless tiger quoll tugs furiously at your shoelace.

The final step is marking the charts clipped to the door of each enclosure, grading the residents' food consumption and stool consistency, recording breeding behavior, and even noting such oddities as a day-glo yellow mushroom that has sprung up overnight in one of the marmoset cages. ("Without the luxury of pure observation time, you develop a sixth sense for the animals' well-being as you go," keeper-leader Kevin Conway has said.) Meticulously recorded, these day-to-day details add up to a lifetime of data vital to the successful breeding and maintenance of these animals.

9:55: Stopping by the hospital before taking a coffee break, we offer the lone but not forgotten Quimby his morning celery treat. "They love the tough ends and leaves—the part we humans throw out," says John, tuck-



ing a second stalk into a notch where Quimby can find it later.

10:20: Back to cage cleaning. This time, we open the door connecting two tiger quoll enclosures, giving Sydney access to his mate-to-be, Alice. Within minutes, the pair is facing off, jaws agape, on Alice's turf. Alice gives a blood-curdling scream, then hisses and puffs violently as Sydney sniffs at her. All in all, says John, it is a typical beginning of a typical encounter.

11:00: I steer a wheeled trash can filled with noisy crickets down the aisle, scooping insects into the enclosures. Rocketing off in hot pursuit, the quolls, fanaloka, marmosets, and tamarins get exercise, excitement, and a nutritional bonus in one package.

The tree kangaroos are due for another celery hand-out, and they approach in fluid slow motion, claws clicking on tree limbs that have been gashed to provide a grip once the bark is stripped away. (In the wild, bark would be a major part of the tree 'roos' diet; in captivity they are fed tannin-rich tea leaves as a substitute.) Appetites whetted, the tree 'roos have lost some of their shyness and this time swipe the celery stalks right out of my hand.

11:40: CRC mammalogist Larry Collins comes through to look in on his charges and discuss the timing of various breeding plans with John. He decides to grant Sydney and Alice, whose piercing shrieks punctuate his deliberations, round-the-clock access to each other.

12:45: After lunch, the juvenile marmosets and tamarins are scheduled for a monthly worming. John shows me how to hollow out a raisin using a large, clean nail, before injecting a syringe of worming paste. I make up a tray that looks suitable for a doll's tea party: two medicated raisins apiece, plus extras in case they are spit out or lost.

The tricky business of worming reveals an interesting facet of the species' behavior: With the very young tamarins, the keeper often gives the medicated raisin to a parent from whom the juvenile solicits the "food." While John doles out medication in one corner, I create a diversion in another, passing plain raisins to a mob of greedy adults—a sure-fire way to win friends and influence monkeys. No matter where I move, Macho seems to get the lion's share; I'm trying to be fair, but on this exotic animal

Unusual marsupials such as the tiger quoll (left) and the tree kangaroo (right) are one focus of research at the Zoo's Conservation and Research Center. (Photos by Jessie Cohen, NZP Graphics.)



farm, as in the wild, some animals are obviously more equal than others.

1:40: Preparing the afternoon feeding in the kitchen, we consult an enormous wall chart that details the prescribed diets by day, with recipes, cage numbers, weights and measures, thawing schedules, and special instructions spelled out in a shorthand code.

A science in itself, diet preparation is one of the first tasks a volunteer learns. At one end of the butcher block counter, I weigh, slice, and dice fruits, vegetables, and canned marmoset diet into tiny cubes, while farther down John creates an impromptu salad bar, filling a line of large salad bowls (they will be hung from the tree kangaroos' wooden perches) with kale, carrots, and other fresh vegetables. The finishing touch is a sprinkle of mixed oats, corn, and Omolene—a sweetened horsefeed enriched with selenium, a nutrient important in muscle maintenance.

Morris, the finicky cat, would feel right at home, for to suit the needs of individual species, every food must be cut and arranged in the pan just so (red pandas, for instance, won't eat through their gruel if the desired fruit is underneath and vice versa). Apples are peeled and cored; even the peanut butter and banana sandwich I make to fatten tree kangaroo Spot is quartered and decrusted.

2:30: I join long-time keeper Tom Schneider at the Commissary to help with the red pandas' afternoon feeding. When we have collected the last armful of bamboo from the walk-in fridge, I sweep out the water puddles and stray leaves. When Conway returns, he will stack about 200 stalks to the ceiling—misted daily with water, the bamboo will stay fresh for a week.

Inside a fenced yard, the normally solitary, tree-dwelling red pandas are housed in oval corn cribs criss-crossed with solid beams that take full advantage of the height. On the floor are pairs of concrete nestboxes with features like peepholes and built-in scales that allow keepers to monitor newborns without alarming the mother. Cool and comfortable, the boxes have been credited with boosting red panda breeding success.

"Good afternoon, Gertrude," Schneider greets a red panda that slowly climbs toward the bamboo stalk he props between tree limbs. Like the others, Gertrude comes to

the ground to eat and drink from her dishes, but seems to prefer nibbling leisurely on the bamboo from on high, bending the stalks with the famous panda "thumbs."

Going down the line, we check the water tanks (a heating element prevents freezing) and swap empty feed bowls and stripped stalks for a fresh supply. Seeing the inquisitive, luxuriously furred animals up close, it's hard to remember that their sharp claws and powerful jaws can deliver a very painful bite. Here, as elsewhere at CRC, familiarity breeds respect; the animals are kept tractable—"user friendly"—so that keepers and vets can work with them closely, but woe to any humans who forget their place or push their luck too far.

Carrying the dirty dishes back to soak in the kitchen, we move on to the South American canids, the maned wolves and bush dogs.

3:00: During the day, the canids have "free choice," coming and going as they please between heated indoor dens and large outdoor yards. (For most of CRC's small mammals, 55 degrees is the "magic number" for outdoor access.) Schneider closes the doors while we take food into the maned wolf dens, then drops the metal pans on the floor with a noisy clatter that summons the animals to their supper. Within seconds, the elegant Beowulf comes loping through the yard to scrabble at the door. Through a two-way mirror, we watch the shy animals eat; one wolf, hearing the scratching of a pencil on the ever-present check sheets, looks up quizzically, foxy ears a-twitch.

Scuttling around on their absurdly short legs, the stocky bush dogs are a somewhat trickier case, as coming in for dinner means getting shut in for the night. As Schneider slides the food pans into the sheds, the animals bound up the chutes from their outdoor yards. My job is to watch through a crack, then quickly close the metal doors down before any of the bush dogs can wheel around and dash back out. At last we pause to carry pans to the kitchen, where I attack the more predictable stack of dirty dishes and leave Schneider to lure the incorrigible bush dog Dolly.

3:30: The day ends somewhere between 3:30 and 4:00. Keepers gravitate toward the break room to collect belongings, write up reports, phone new births in to the Zoo registrar, and

tie up loose ends. Home, for some, is a few short steps away in the Center's houses and dormitories, where staff and families, visiting scientists, students, and some full-time volunteers form a small, social community, boasting everything from volleyball to a volunteer fire company.

Home on the Hills

Outdoor work with the hardy crew of hoofed stock keepers adds another dimension to the volunteer experience. One November day out with hoofed stock keeper-leader Bobby Rodden and keeper Ken Lang leaves me convinced that as much as the attentive animals and the absence of visitors, the stunning, 360-degree Blue Ridge view makes this "zoo" truly unique.

While the outline of the daily hoofed stock routine roughly mirrors that for small mammals (count noses, feed, and check for seasonal new births in the morning; move animals, clean barns, and fit extra projects into the afternoon), these tasks are spread over a few thousand acres of pasture sandwiched between 40 miles of chain-link fence.

The work is hard but every task pays off with a new surprise. Rumbling up sheer, trackless slopes in a vintage army surplus jeep; opening and closing gate after double gate; breaking and tossing bales of hay into a rack as a herd of zebras thunders up to feed; single-handedly stacking two tons of animal chow sacks; glimpsing local wildlife along the ridgetops—bluebirds, sapsuckers, hawks, foxes, white-tailed deer—and exotic species scattered across green fields—Przewalski horses, Persian onagers, European wisent, scimitar-horned oryx, sable antelope, Eld's and Pere David's deer; spotting a newborn muntjac, still wet from birth, hidden in a clump of yellow grass. . . . An eight-hour whirlwind of "the zoo experience," the memory of this day offers the greatest temptation to a sore and weary volunteer to return at sunrise the following morning, to sign on for the season. □

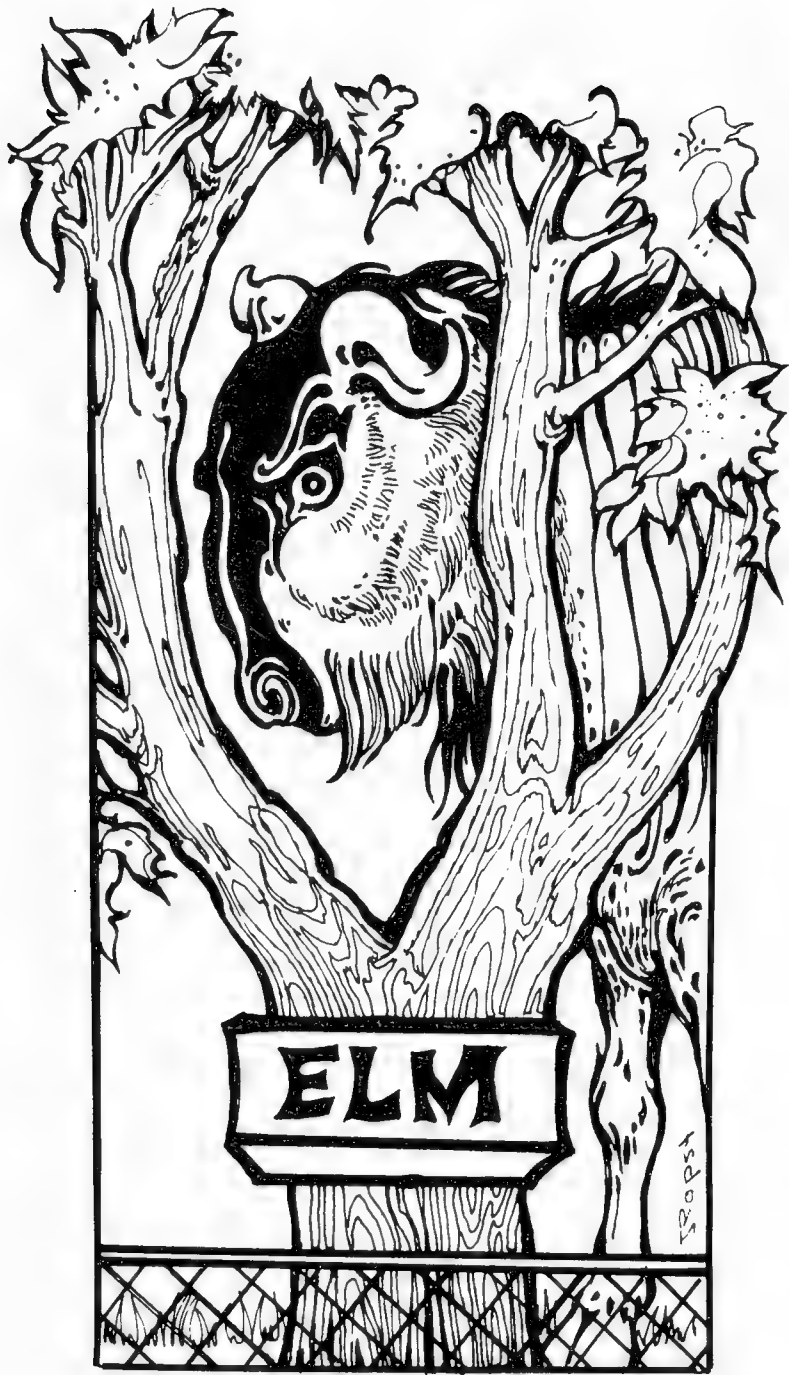
For further information on volunteering at CRC, please contact Larry Collins, c/o Conservation and Research Center, Front Royal, VA 22630 (703) 635-4166. Information about the Keeper Aide program at the National Zoo is available from Jo Anne Grumm in the FONZ Office of Volunteer and Educational Services (673-4955).

John -

Thanks again for your help with this
article - wish I could turn into a
volunteer. We have a new editor here -
Susan Lumphon, formerly of DZK -
and great plans for the future. The dump
war is heating up & looks like the developer
will try to get a hearing as soon as the election
arr. See you in the Superfresh parking lot!
Susan

Keepers' Corner

True Tales from Zoo Insiders



Signs identifying trees are in evidence around the park. Overheard more than once after a tree was labeled in the wildebeest yard:

—What are those animals anyway?
—Can't you read the sign? They're elms!

—Helen Moore
FONZ O.V.E.S.

I watched one day as a keeper released a male jaguar from the holding area. As was his custom, the animal began to race toward the outdoor enclosure through a female's empty cage. But this time he suddenly jammed on the brakes, almost flipping over his head, and started to sniff a spot on the floor. Quipped the keeper, "Oops, he tripped on a pheromone!"

—Cathi Mathias, Keeper
Department of Zoological Research

I used to dread working in the bearded dragon enclosure when we housed that species a few years ago. Since I have a beard, whenever I worked in that exhibit, visitors would invariably ask, "Which one's the lizard?"

—Bela Demeter
Reptile Keeper-Leader

One afternoon in the Reptile House, two men peered intently into the glass lizard exhibit. Unbeknownst to them the lizard was out of sight, sleeping under a log.

After several minutes, one man turned to his companion and said, "I don't see any lizard."

Pointing to the front of the exhibit, his friend replied, "It's right there, but you can't see it. That's why they call it a 'glass' lizard."

—Bela Demeter
Reptile Keeper-Leader

Like many animal groups, the margay cats at the Brookfield Zoo lived in a self-established hierarchy. As their keeper, I realized that the order in which they ate was one of their ironclad rules. One day I made the mistake of entering the exhibit with a pan of meat and offering it first to the "low cat on the totem." Before she could take the first bite, the top dog—or rather cat—raced down the tree and across the floor and nipped my ankle.

I can't say I blamed her, for I'd broken the rules. And I doubt she meant to hurt—it was just a gentle warning not to question her dominance again.

—Cathi Mathias, Keeper
Department of Zoological Research

Panda Watch 1987

(continued from p. 17)

the hope that Ling-Ling would return to camera range during their watch.

For the next two days, everything went smoothly. Watchers—who still had nothing to watch—learned to distinguish between the cries of the cub and those of birds. The sex of the cub was the question of the hour, closely followed by speculation on a name.

Then, on the evening of June 26, volunteers began to record near-continuous vocalizations from the cub. Staff members saw nothing unusual during their regular visual checks on Ling-Ling but were unable to hear the vocalizations from their observation point inside the Panda House. At about 8:30 p.m., Ling-Ling began prolonged bouts of licking, which were clearly audible through the microphone. Shortly after 11:30

p.m., she left the cub for the first time since its birth, and the veterinarian determined that it was dead.

Stunned volunteers followed the watch schedule for the next three days until it became clear that Ling-Ling was returning to her normal routine. In the words of one observer, that period was "more like a wake than a watch." The last shift ended at 7 p.m. on June 29, two weeks to the day from the start of the watch. The following Saturday, watchers gathered for another meeting, this time to hear a summary of the autopsy results and to learn of plans for the future.

For the volunteer corps, as for panda fans everywhere, the death of this cub hit particularly hard, coming just as many hoped that the cub had passed through the most critical state. Yet despite their disappointment, the Zoo staff and medical team pressed on in the days that followed, gathering

more information and building on knowledge gained from previous births. Time may be running short for the aging Ling-Ling, but the excellent mating and maternal behavior she has demonstrated continues to inspire confidence for the future. Perhaps the experience of 1987 will one day appear in hindsight as a stepping stone to the successful rearing of a panda cub at the National Zoo. □

JOBS AT THE ZOO

FONZ is now accepting applications for full and part-time positions. Autumn is a beautiful time to be at the Zoo. Enjoy the environment, and be instrumental in helping our visitors have a most enjoyable day. FONZ jobs are excellent for students, housewives, retirees, etc.

Don't delay! Call now: 673-4640, Mon.-Fri., 9 a.m.-4 p.m.



Jessie Cohen, NZP Graphics

Keeper Morna Holden with new rhino calves

RHINO CALVES

It was the perfect gift for the country that has everything: At 11 a.m. on the third of June, His Royal Highness Prince Gyanendra Bir Bikram Shah of the Kingdom of Nepal presented two female greater one-horned rhino calves to the people of the United States c/o the National Zoo. "Kali" and "Mechi," aged 10 and 14 months respectively at the time of presentation, can now be seen together in the Elephant House, along with adult male "Pandau," their neighbor and prospective mate in years to come. Throughout the long, hot summer, a water jet sprayed a cooling mist through their enclosure; a mud wallow provided outdoor relief; and keepers supplied the young rhinos with several "toys"—trash baskets and bowling balls—on which to vent their youthful energy.

The rhinos have been named for two rivers that border Nepal—names which Prince Gyanendra said "symbolize the joining together of Nepal and the United States in friendship and cooperative conservation efforts."

The gifts are intended to draw attention to the crisis faced by rhinos in the wild. Rhino populations of all species have declined 84 percent worldwide since 1970, and the number of the greater one-horned variety rests somewhere close to 1500. Royal Chitwan National Park, from whence the rhinos came, is one of only two places in the world where populations of more than 50 greater one-horned

rhinos exist. The drastic declines can be attributed chiefly to poaching and habitat destruction. But there is reason for hope. The population of Royal Chitwan's greater one-horned species has quadrupled since 1969, soaring from an all-time low of 108 animals to upwards of 360, thanks to increasingly aggressive research and conservation efforts. One such effort is the Terai Ecology Project, a joint program of the Smithsonian Institution and the Government of Nepal. Coordinated state-side by NZP Assistant Director for Conservation Chris Wemmer, and in Nepal by Hemanta Mishra, much of the Project's research is currently focused on rhinos and their relationship to Chitwan's lowland plant community.

The timely gift of the rhinos will enable the National Zoo to cooperate with other zoos and Nepal in an international captive breeding program that may serve as a hedge against the species' extinction since its fate in the wild is still uncertain. —Heidi Hall

NEW AT THE ZOO

In addition to the one-horned rhinos, recent arrivals include a pair of Bactrian camels housed in the front yard of the Panda House; a mara—a hare-like South American rodent—in the Hardy Hoofed Stock area; snake-necked turtles in the Reptile House; and giant clams and sea nettles in the Invertebrate Exhibit.

New births during the spring and

summer include a colobus monkey and a lion-tailed macaque in the Monkey House; a bongo, a blesbok, dorcas gazelles, and Reeve's muntjacs in the Hoofed Stock area; bobcats in the North American Vertebrate area; a Masai giraffe in the Elephant House; a red panda in one of the Panda House yards; golden-headed and golden lion tamarins in the Small Mammal House and Beaver Valley; and arrow poison frogs hatched in the Reptile House.

RETURN TO THE WILD

Though they came from the West Coast, the East Coast, the Midwest, and even from an island in the English Channel, they all had one destination: the forests in and around the Poco das Antas Reserve in Brazil. The travelers, 22 golden lion tamarins, came to the National Zoo in August to be examined by veterinarians and prepared for their release into the wild in September. The eight males and 14 females composed the third group of zoo-born monkeys shipped to Brazil by NZP in four years.

The shipment of the squirrel-sized tamarins on September 8 and their release in the Poco das Antas area between September 9 and 11 marked another milestone in the Golden Lion Tamarin Conservation Program, an international effort to save the species and its habitat. The Program is administered by Devra Kleiman, NZP Assistant Director for Research, who began work on the project in 1972 when only 70 golden lion tamarins were living in zoos and a few hundred survived in the wild. The monkeys did not breed well in zoos and their future in the wild appeared dismal, since their unique forest habitat was being destroyed. Kleiman launched a major research effort that led to the development of successful methods for breeding, feeding, and housing golden lion tamarins in zoos. By the late 1970's NZP had become the principal breeder of the species and sent many monkeys to other zoos that wished to participate in the captive propagation project. In 1984 golden lion tamarins in zoos around the world numbered 371; their survival in captivity was assured.

The situation in the wild, however, was anything but secure, for deforestation had continued at a rapid rate.

By 1984 only 2% of the original eastern coastal forests were left and only parts of that were suitable for sustaining tamarin populations. At the urging of a leading Brazilian primatologist, Ademar Coimbra-Filho, the Brazilian government established the Poco das Antas Reserve in 1974. The Reserve is a 12,000-acre patchwork of forest and reclaimed farmland lying 80 miles east of the city of Rio de Janeiro. It is the largest area of remaining tamarin habitat and is home to about 200 of the monkeys.

In conjunction with the Brazilian government and Coimbra-Filho, who heads the Rio de Janeiro Primate Center, the NZP decided to send zoo-born lion tamarins to Poco das Antas and adjacent areas to bolster the dwindling wild populations. A team made up of NZP General Curator Ben Beck and research associates Jim and Lou Ann Dietz joined Kleiman to undertake the reintroductions. Zoos in North America and overseas were contacted to see if tamarins were available for release. The response was enthusiastic, for many zoos had become successful breeders of the monkeys and were willing to provide animals.

Under the watchful eyes of Kleiman, Beck, and the Dietzes, 13 tamarins were gathered from five U.S. zoos including NZP and released in Brazil in May 1984. A second group of 11 was released in August 1985. Currently, of the 24 monkeys reintroduced in 1984 and 1985, four of the original zoo-born animals still survive. Happily, the two releases resulted in three wild-born descendants, so prior to the most recent release, seven of the Reserve's golden lion tamarins had zoo origins.

Devra Kleiman said, "This latest release is special—it involves more animals than ever before and new, innovative techniques." The Zoo's Ben Beck is largely responsible for developing the new procedures that permit the overnight shipment of tamarins from North America to Brazil and their immediate release into the wild. The activities of the monkeys are then controlled by the strategic placement of provisions, nest boxes, and ropes which serve as arboreal pathways where tree branches are missing.

Also new, according to Kleiman, "is that several private land owners are

providing forest sites for the reintroductions. Their participation in the project increases that habitat that is now available to the tamarins, and more protected forest will improve the possibility of the long-term survival of the species in the wild."

OPEN-AIR EXHIBIT

An experimental release of golden lion tamarins initially conducted in 1986 was repeated in the Park last spring with encouraging and exciting results. The 1987 release involved a family group of five mature adults (all veterans of the first release), one juvenile born in the early spring of 1987, and two late additions—a healthy set of twins born mid-August in the wilds of Beaver Valley. Exhibit curator Ed Bronikowski provided the group with a nest box, a tree-to-tree network of vine-like ropes, and a series of feeding stations—in short, all the comforts of home. These measures allow independence but encourage the group to stay close to the release site. Until the advent of cooler weather, zoogoers can witness the adventures of the six roving red-heads as they test the limits of their open-air "exhibit."

NZP General Curator Benjamin Beck proposed the 1987 release to further his research on reintroduction of golden lion tamarins to the wild, and to present an innovative, naturalistic, low-cost primate exhibit to NZP visitors. Beck had found that zoo-born tamarins released in Brazilian forests were reluctant to leave their nest box

and food supply. He reasoned that the initial reluctance of these territorial primates to roam widely could be viewed as a "psychological cage." The success of the "cage-less" exhibit has in turn led Beck to revise the Brazilian reintroduction strategy.

"In previous reintroductions," Beck said, "the tamarins were kept and trained in large cages in the forest before release. They learned foraging and locomotion skills in these cages, much as a student learns to fly in a flight simulator. In 1987, the tamarins will be released from familiar nest boxes directly into the Brazilian forest and then trained, like learning to fly in an actual airplane. This will be more realistic and cost-effective training, and is a fine example of the interplay between zoo and field research."

During the first release on Zoo grounds, the six monkeys had to learn what it meant to be free and how to adjust to unlimited territory, yet remain a family group and return to their nest box each evening. This spring, when the experiment was repeated, the needed skills seemed to return to them naturally. In fact, the youngest juvenile of the group, four-month old "Vern," proved most adept at activities such as climbing and hunting. Although the tamarins are provided with food, the urge to hunt apparently remains strong. With the exception of the newborns, all members of the group are now skilled at foraging for insects in the trees, as well as on the ground—a surprise, since tamarins in their native Brazilian habitat don't usually hunt on the



Tamarin afield

Jessie Cohen, NZP Graphics

NOTES AND NEWS

ground, where they are vulnerable to predators.

The Zoo's golden lion tamarins have acquired a number of urban survival skills as well, such as adopting the fence rail as sort of a substitute tree branch. As the monkeys have grown more secure their range has expanded—forays now include expeditions to the gibbon enclosures and visits to the back of the Small Mammal House, where they have territorial encounters with another group of golden lion tamarins.

Though the free-ranging tamarins have become more curious and assertive, those overseeing the project are not worried. "No one is trying to fight their natural behavior," said Mike Power, one of several researchers involved in the project. "We are more interested in providing situations which will encourage appropriate behavior."

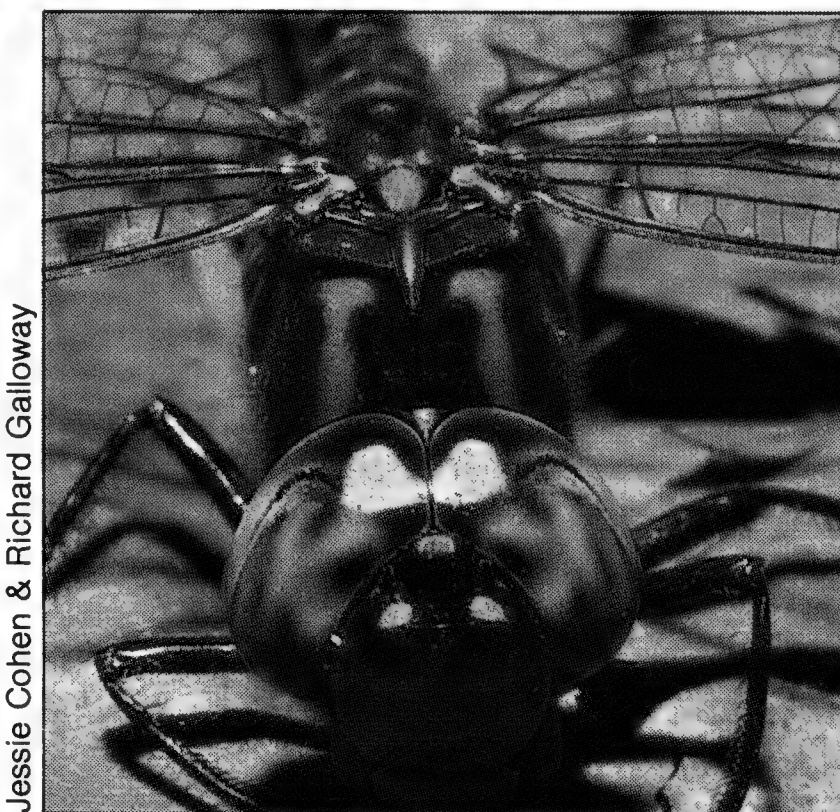
FONZ volunteers have been on hand throughout the project to monitor the tamarins' activities, record data, and discourage close encounters with the public. The logic governing this exhibit, as explained by Power, is straightforward: "We're relying on the good sense of the monkeys and the good sense of the public."

As many zoogoers are aware, golden lion tamarins are endangered in the wild, where the remaining 300 or so animals live chiefly in the Poco das Antas Reserve of south eastern Brazil. This small strip of coastal forest is the last remaining natural habitat of golden lion tamarins; protection of this land is crucial to the species' survival.

The National Zoo's reintroductions of tamarins into the Reserve have proven quite successful and have aroused community support and awareness about the plight of the species. The release on National Zoo grounds serves several functions as well, bringing a novel conservation message to the public, sparking interest and awareness of the Brazilian reintroduction program, and providing researchers with valuable data for the current Brazilian release. —Heidi Hall

INFAMOUS INSECTS

Creatures of stunning beauty and complexity live out their lives around our homes, affecting us profoundly



Jessie Cohen & Richard Galloway

Dragonfly

although we seldom notice them. In *The Pleasures of Entomology*, author Howard Ensign Evans opens a window onto a new world—the world of insects and the rare breed of humans that have dedicated their lives to the study and appreciation of these diverse animals. Evans, whose 50-year passion for insects rivals the zeal of the most ardent birdwatcher or gardener, says there is much to be lost and little gained by loathing insects.

In his writings, Evans points to insects as a constant source of discovery, describing their intricate relationships with other animals and plants, their bizarre sex lives, and the often amazing discoveries scientists have made while attempting to study and sometimes control these creatures. Of the estimated 30 million species of insects that fly, creep, swim, or crawl across the globe, Evans singles out some of North America's most infamous insects for special attention: the introduced gypsy moth and Mediterranean fruitfly, the rapidly spreading "killer" bees, the much-maligned flea, and the constantly copulating lovebugs that swarm around Gulf Coast highways, among others.

Evans devotes equal time to the lives of entomophiles—human lovers of all that is insect. He describes pioneer naturalists and modern entomologists, who boast lives as unique as their subjects of study. Consider, for example, the early American entomologist Thomas Say, who described 1500 insect species, only to have his extensive collection destroyed by beetles in the end. The author writes of his own travels around the world in pursuit of insects, yet also details

wonders found as close as his own backyard. Black-and-white drawings by Peter Eades illustrate each chapter. (Published by Smithsonian Institution Press, 238 pp. \$14.95.)

—Howard Youth

SUNDAY MOVIES

The 1987-88 Sunday Afternoons at the National Zoo series will feature free movies monthly from November through March in the Education Building Auditorium. Tickets are required and must be picked up in person. Scheduled for 1987 are *The Gods Must Be Crazy* (comedy) on November 22 and *An American Tail* (animated adventure) on December 13. Showings begin at 1 p.m. For further information, call 673-4717.

LETTERS

Dear Zoogoer,

Thanks so much for printing a picture of lion-tailed macaque Gustav. I never could get a good enough picture of him in his enclosure.

I hope Gustav is back in circulation again where people can see him. During my last two visits to the Zoo, he was being taken care of "below stairs." He is a real character and worth going to see. Hope he's okay!

—Blythe Hedge
Bethesda, Md.

You will be happy to know that Gustav is on exhibit once again. He was taken off exhibit last winter because all the monkeys have indoor and outdoor access during the winter, and we were concerned that Gustav, at about 28 years old, might become chilled in Washington's coldest weather. Gustav spent the winter months with his mate and infant in the Propagation Building.

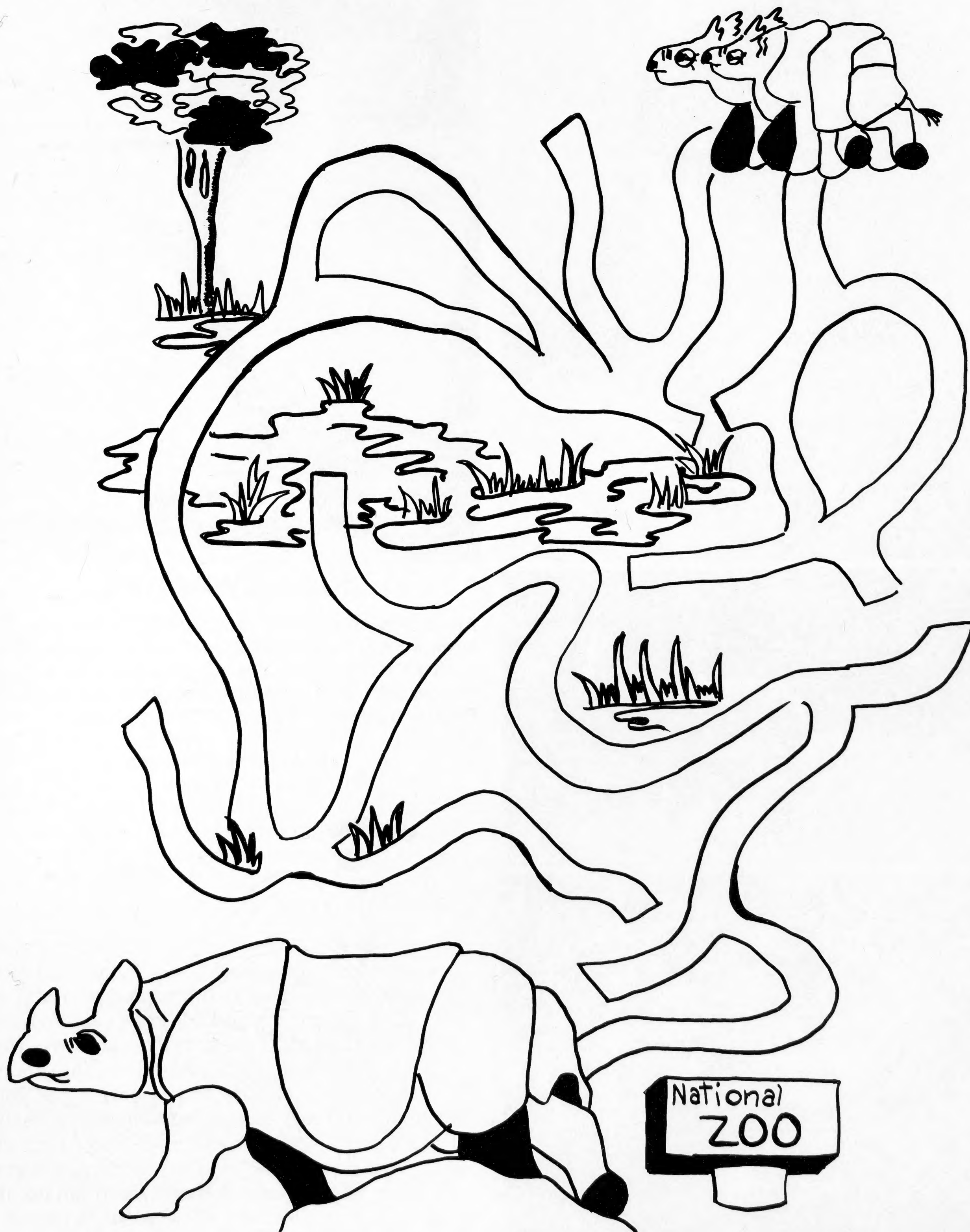
—Rob Shumaker
Primate Keeper



Jessie Cohen, NZP Graphics

Lion-tailed macaque Gustav

RHINO MAZE: Last summer the Asian country of Nepal gave two one-horned rhinos to the United States. Can you help this young rhino pair find their way to join adult rhino “Pandau” at the National Zoo? (Solution on page 26) By Barbara Borderieux.

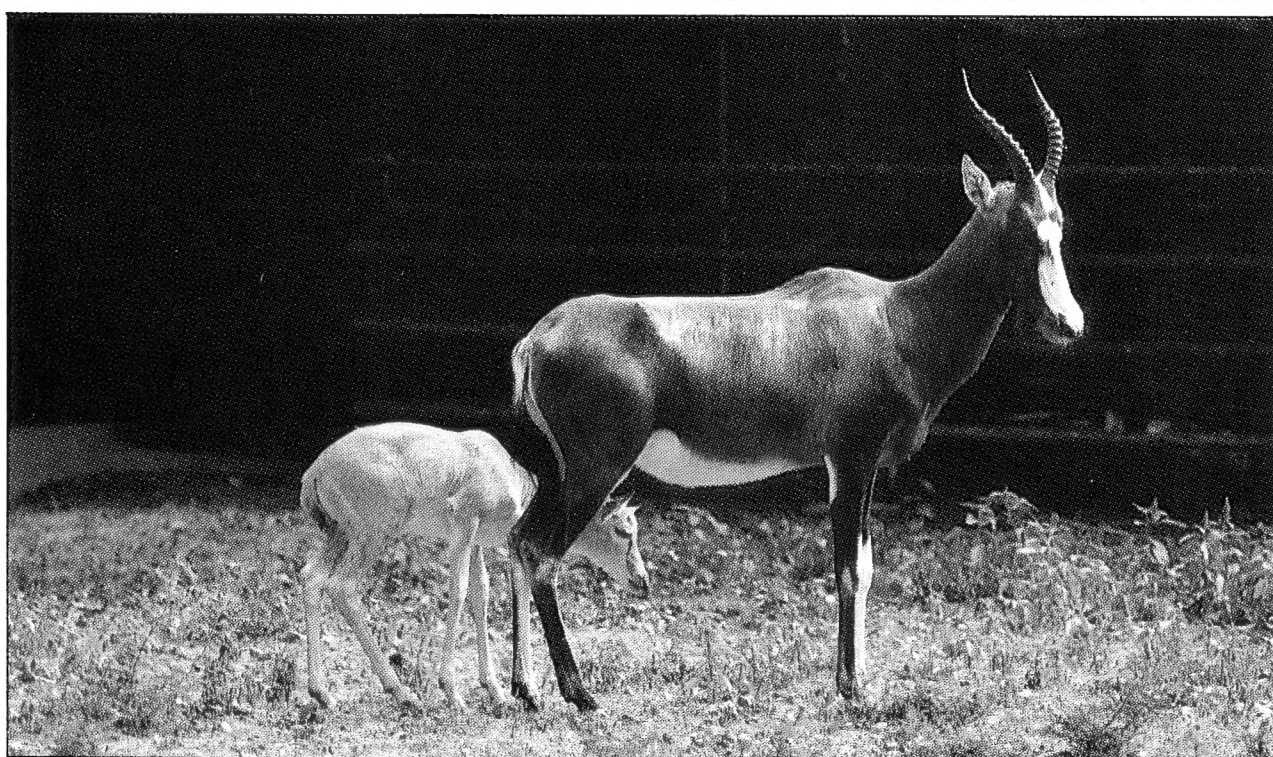
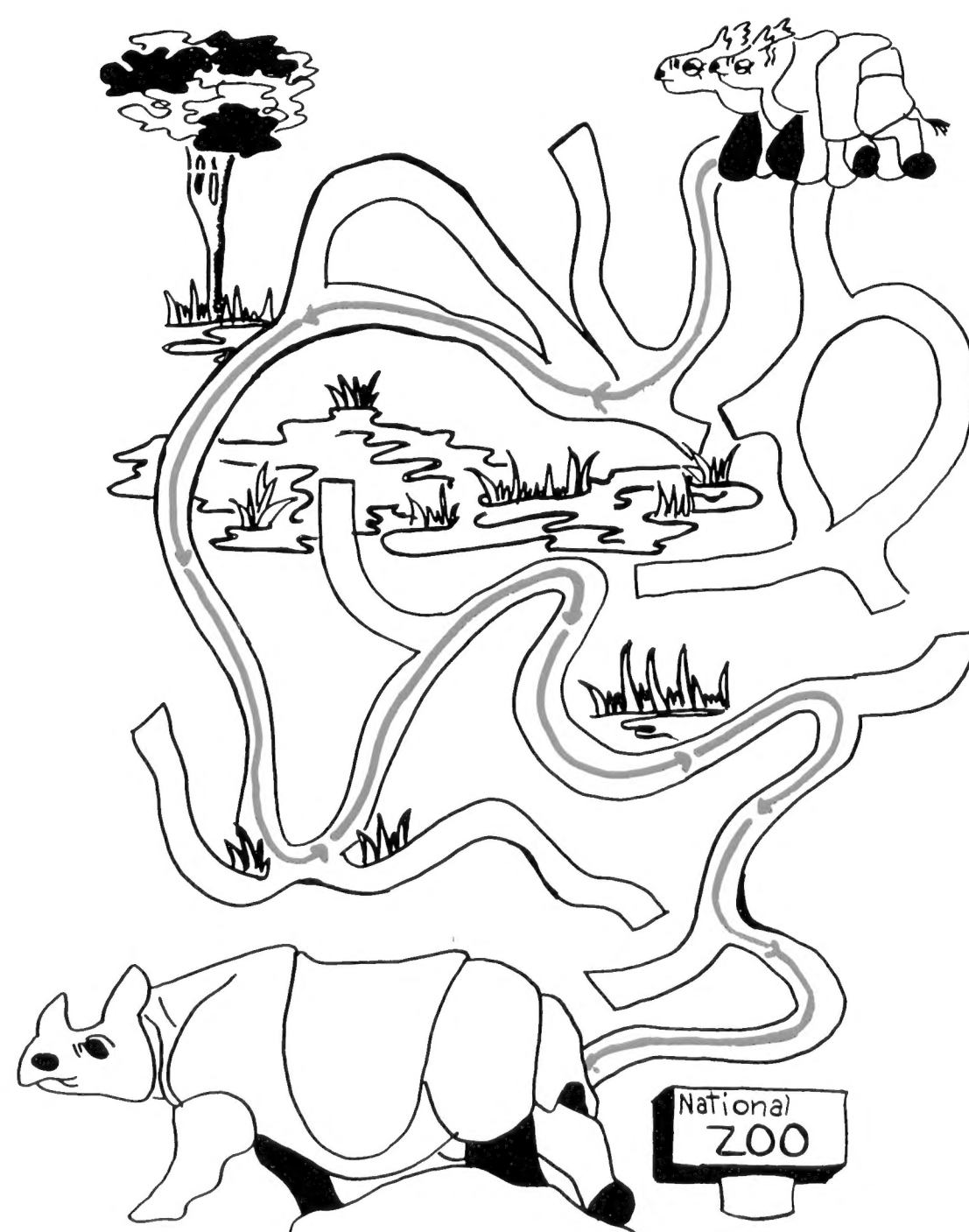




ZOO NEWBORNS

Among the many new animals born at the Zoo last summer were a giraffe (above) and a blesbok (left), both native to Africa, a North American bobcat (below left), and an Asian orangutan (above left). Photos by Jessie Cohen, NZP Graphics.

Rhino Maze Solution



The Capable Camel

Imagine that you lived in a place that was nothing but sand and sky, as far as the eye could see. By day the sun would glare down on the sand, sending the temperature as high as 100 degrees and making your home as hot as the hottest summer sidewalk, with no grass or trees to break the heat. Sometimes a raging wind would whip the sand up into your eyes, nose, and mouth. To top it all off, you might have to walk as far as 30 miles in a single day, with 600 pounds of someone's property loaded on your back, for thirty days on end, without a single sip of water.

Who could live like this? Only a camel!

To most of us, the desert does not appear to be a friendly place. Yet camels are amazingly well adapted to this harsh landscape. Their ears and nostrils are curved to keep out sand and wind. Their eyes are rimmed with long and lovely lashes that filter dust. Camels' eyes also have three protective eyelids. The innermost lid is transparent, so a camel can close this lid and still see where it is going, as though it were wearing goggles. A camel's toes are widely splayed, like a snowshoe, which keeps the heavy animal from sinking in the sand.

So how can a camel go so long without water? This is still something of a mystery. You might think they were taking extra gulps and storing the water in their humps, but this is not the case. We now know the humps are mostly fat, rather than chambers full of water.

If you visit the two new camels at the National Zoo, you will notice that they have not just one hump, but *two*. They are Bactrian camels, a type generally found in southern Asia or western China. One-humped camels, called Dromedaries, are found in Northern Africa or the Middle East. But no matter where a camel comes from, you can be sure that place is hot. And if the humps don't carry water, how *does* the camel survive?

It seems that camels are especially good at saving what water they *do* drink, and can withstand the loss of body fluids better than

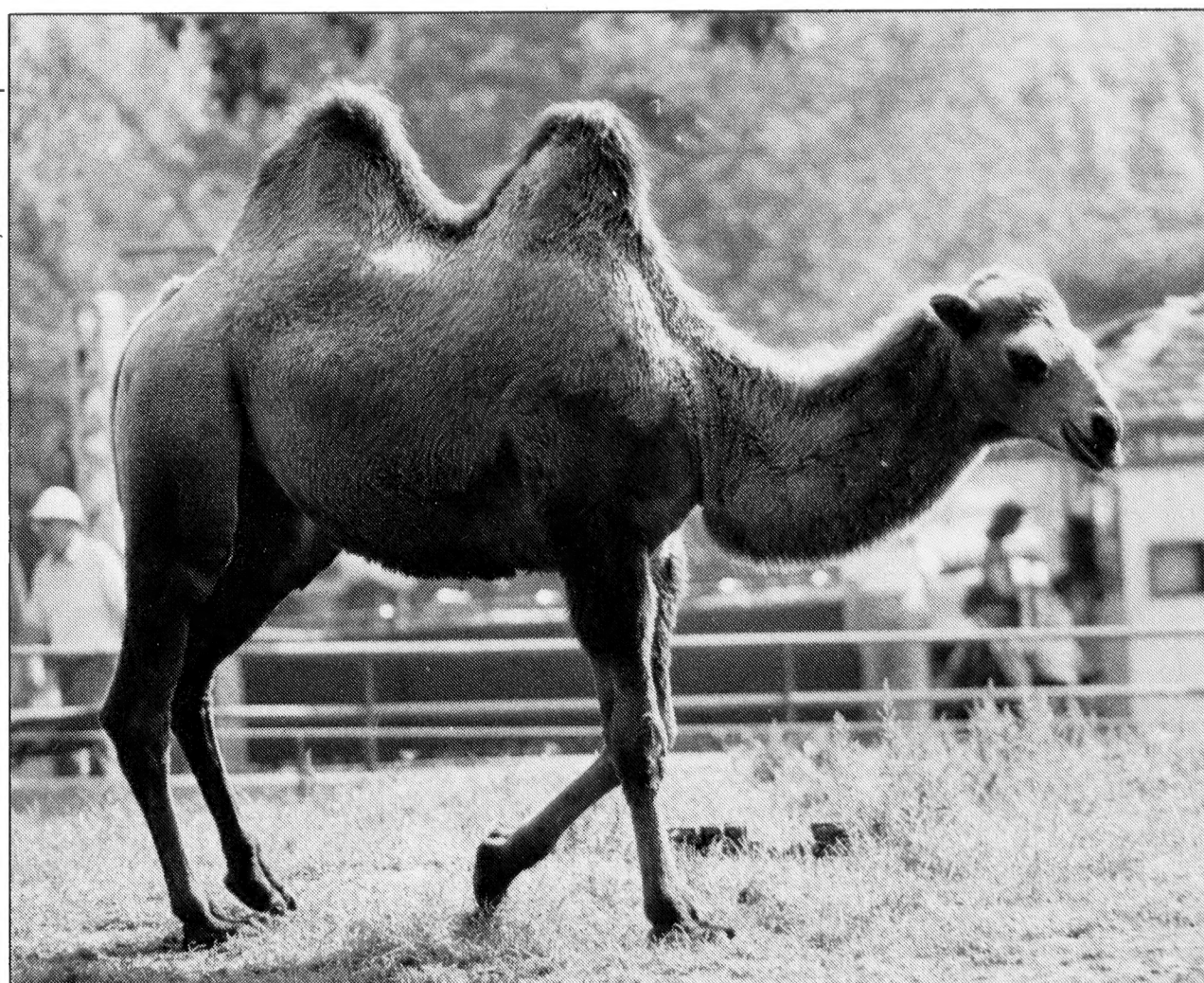
most other mammals. A camel can lose almost half its total body weight and two-thirds of its body's water content without getting sick. In order to save water, camels sweat very little and release only small amounts of urine. When a camel stands out in the sun, it points its body away from the sun, exposing as little of itself as possible to the sun's drying rays.

Perhaps the camel's most amazing talent is its ability to *smell* a source of water. A camel can smell a water hole from as far as six miles away. Once it arrives, a thirsty camel can drink as much as 50 gallons at a time, transforming itself from a wrinkled, shriveled beast into a plump and healthy animal that's ready to hit the desert trail again.


The Zoo's camels have never wandered in a desert; both were raised in North American cities with rather chilly climates. "Camille," the female, came to Washington from Toronto, Canada, while "Saki," the male, came from Madison, Wisconsin. Neither camel has ever set foot upon a sand dune, and neither one will ever have to trudge across a desert landscape, loaded up with pounds of luggage. But both still share those traits that suit all camels to life on the glittering sands.

—Heidi Hall

Jessie Cohen, NZP Graphics



New female camel "Camille" explores her outdoor yard beside the Panda House.



New
At
The
Zoo
(p. 22)

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